The Northwestern MILLER
MILLING PRODUCTION SECTION

How Do YOU Figure Your Flour Yields?

By John M. MacKenzie
University of Minnesota

THERE are three common methods of computing flour extraction rates, or flour yields, in use by millers in the U.S. Those three are: Elevator, production, and wheat-over-rolls. Some millers refer to the elevator yield as the "dirty wheat" yield, because it is an expression of the amount of flour obtained from the wheat as purchased and takes into account screenings taken off but paid for as wheat, any alterations in the wheat during processing in the cleaning house and any milling loss.

The elevator or "dirty wheat" yield is, therefore, used mostly for computing flour prices. The flour extraction can be calculated only by this method over long periods because of the difficulty in assessing accurately the wheat used.

If a mill is equipped with automatic scales to weigh wheat to the cleaning house, the dirty wheat or elevator yield can be figured weekly, but where scales are not available, the wheat used is figured by stocks at the beginning and end of the period and receipts and withdrawals during the period of record.

A study of the flour milling products summary for 1951, published recently by the Bureau of the Census, U.S. Department of Commerce, discloses many rather interesting variations and averages in flour yield, offal produced, product gain or loss in the milling operation and flour extraction rates between mills in different states.

It should be explained that the Bureau of Census, in its requests to milling companies for statistical information, asks that the mills report wheat used "in the same condition as purchased." It can be assumed, then, that the "wheat used" figure for each state is elevator wheat of varying moisture contents, varying amounts of screenings, etc.

The variations between mills in different states suggested some further inquiry into the matter and a group of milling superintendents, recognized for their abilities, were asked for their opinions and comments about the different methods of reporting flour yields, the advantages of each method, and whether or not they believed that one standard or uniform method could be adopted for the nation as a whole. Their replies are quite interesting.

Most all of the superintendents employ the wheat-over-rolls and total products methods as an indicator of mill performance or in controlling the operation of the mill. All of the superintendents used the elevator wheat yield as a control for economic tests as well as mill practice.

The following table presents an extension of the data reported by the Bureau of the Census. Its report showed only the pounds of wheat used per sack of flour produced, and the pounds of offal produced per sack of flour. The product gain or loss and the flour yield were computed from those data.

Average Number of Pounds of Wheat Required, Offal Produced and Product Gain or Loss, Per Sack of Flour*

State—	Wheat req'd lb.	Offal yield lb.	Gain or loss lb.	Flour yield %
Kansas	140.5	40.8	0.3	71.1
Minnesota	137.6	39.3	1.7	72.7
New York	138.8	38.6	—0.2	72.1
Missouri	141.0	41.3	0.3	71.0
Illinois	141.0	40.0	—1.0	71.0
Texas	140.3	40.7	0.4	71.2
Oklahoma	140.0	40.1	0.1	71.4
Washington	136.0	37.3	1.3	73.4
Ohio	141.5	41.5	0.0	70.8
Nebraska	139.0	38.7	0.7	71.9
Oregon	136.3	36.9	0.6	73.4
California	136.8	37.5	0.7	73.3
Michigan	142.6	41.9	—0.7	70.3
Utah	137.0	38.5	1.5	73.0
Colorado	138.3	38.3	0.0	72.6
Iowa	140.8	41.5	0.7	71.1
Montana	138.7	38.9	0.2	72.1
North Dakota	141.3	41.1	—0.2	70.8
Indiana	145.9	46.0	0.1	68.7
Other states	145.7	44.8	—0.9	68.7
U.S. average	140.1	40.4	0.3	71.4

*Data from the Bureau of the Census, U.S. Department of Commerce, "Flour Milling Products, Summary for 1951."

A manager of a spring wheat mill in Minnesota said that his company figured its yields on several different bases. "We have a 'dirty wheat yield' which includes dockage. We have a 'net bushel or paid-for wheat yield' with the dockage taken out and we also use a 'tempered wheat yield' going over the first break rolls," he explained. The manager said that his company formerly figured a products yield but that was before his plant was equipped with scales to record the weight of the tempered wheat going to first breaks.

"Personally, from an economic point of view, we think that the net bushel yield would serve the purpose best," the miller asserted. "From a milling standpoint the tempered wheat or the wheat going over the first break is the best indicator," he added, explaining that in that way it puts all mills on as equal a basis as possible.

The production yield basis is preferred by one prominent midwestern superintendent as a standard basis for reporting mill performance. He explains that with a production yield basis, mill inventories of wheat would normally show a gain unless the wheat received was abnormally high in moisture. "If a clean, dry wheat yield was used, it might result in an erroneous cost figure per unit of flour produced," he said.

A miller in the Eastern states outlined what he believed to be the specifications for an ideal system of reporting flour yields. He recommends that the data on wheat used should be corrected for three factors: the moisture content of the wheat as received, for the test weight, and for the amount of screenings in the wheat. He said that production figures for flour and millfeed should also be based upon a fixed moisture content such as is used by the American Association of Cereal Chemists in reporting research results. (The AACC protein and ash data are all computed on a 14½% moisture basis.) The Eastern states miller said that, in addition to that list of desirable features in yield figures, some other obvious conclusions arrived at were as follows:

1. Production yields are suitable for mill control purposes, but they are impractical in multi-unit plants for the millfeeds are pooled and shipped bulk.

2. Wheat-over-roll yields are good for mill control, but one has no way of determining total raw material cost.

3. Elevator yields are the only yields that count as far as an owner is concerned. The miller explained that to have control of a process and at the same time reflect true raw material costs, it is necessaary that several methods be used for calculating yields. "We use every method we can," he said, "and the number of methods is limited only by the measuring devices available in any plant."

With regard to the data published by the Bureau of Census, he said that perhaps that data could be made more realistic if the elevator wheat figures used by the bureau were adjusted for moisture. Flour and feed figures would be acceptable as fact, he believed. "I doubt if there is anything to gain in reporting flour and feed moistures and correcting to a common moisture," he said. "Test weight could be reported, but I don't know of a test weight correction factor that would hold for all types of wheat."

This miller said that adjustments for screenings are desirable within a plant or a company if one is trying to work up comparable yield figures, but he doubted if a screenings adjustment would help improve the data reported by the Bureau of the Census.

The superintendent of a large mill specializing in soft wheat flours is of the opinion that no direct comparison can be drawn between mills' respective yields, because of the great number of variable factors that would enter into any equation that might be set up to measure the overall efficiency of one mill as compared with another.

This soft wheat miller is in agreement with the other superintendents regarding the use of the elevator or dirty wheat yield as a final check. He said that the dirty wheat yield represents a "true yield" and may be translated into money by knowing the price of the wheat and the selling price of the flour and millfeeds.

He recognized the value of the products yield and wheat-over-roll yield as mill control devices but he said that these could be used only as mill control measures.

"It should be pointed out that none of these methods are infallible in making a comparison between mills either within or outside a given area or region. Factors which, for the most part, cannot be compared but do have an effect on flour yields are as follows: Variety of wheat, test weight, thickness of bran coat, size of kernel, amount of dockage, amount of screenings and extraneous material, nature of wheat mixtures where several varieties or types are used, invisible loss due to moisture evaporation in the grain handling and cleaning system, the invisible loss in milling system caused by evaporation and dusting out, the natural moisture content of the wheat, the tempered moisture content of the wheat and the moisture gain or loss during the milling operation.

A miller in the Pacific Northwest explained that there was no mystery about the product gain of 1.3 lb. per sack of flour produced in that region of the country. He explained that wheat moistures of 9% or probably less were not uncommon and also that wheat in the Pacific Northwest

(Continued on page 16a)

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Responsibilities Under the Grain Sanitation Program

By T. F. Winburn

AS technical and research advances are made each year in our way of life, better products and tools are produced which make life a little better for all. All phases of everyday living have been vastly improved in the last decade or two and the food industry is no exception. Going still further the milling and grain industries have made gigantic steps in the advancement of methods, procedures and in finished products for distribution to the public.

This has come about through advancements in better varieties of wheat and other grains, improvements in machinery, technical knowledge, products control, transportation, sanitation and all the other parts of the industry that make it what it is today.

One great step has been taken in recent years that has done a great deal to improve the entire output of the milling and grain industries. This has been the program of mill and grain sanitation. This program is being enlarged all the time as new information is obtained and great progress has, and is, being made.

Editor's Note—The accompanying article was adapted from the manuscript of an address presented by Mr. Winburn at the 1952 convention of the Pacific District, Association of Operative Millers. The author is manager of the Industrial Fumigant Co., Kansas City.

Milling Industry Clean-Up Campaign

The cereal industry first began to take positive steps in the direction of better sanitation when the Federal Food & Drug Administration instituted its program of mill inspection and control several years ago. This stiffened program by the FDA consisted of a more rigid enforcement of the Federal Food, Drug and Cosmetic Act of 1938 as it applied to the milling industry. Mills were thoroughly inspected and recommendations were made. Flour shipments that were found to be in a contaminated condition were seized and the milling industry began to seek out the answer to the problem that faced it.

At first, the mills thought the impossible was being asked of them, but as time went on, new methods, new ideas, new versions of old ideas, new materials and technical knowledge, and a great deal of hard work began to pay off. Conditions improved and the milling industry literally pulled itself up by its bootstraps and today it ranks among the leaders in the field of sanitation.

As the mills and processing plants began to come up to the high standards they now have attained, the program was expanded to make even higher levels of sanitation possible. The methods of transporting and storing the finished products were studied, and are being actively worked on at the present time.

As an example of this, the committee appointed jointly by the Millers National Federation and the American Institute of Baking to work with the railroads on boxcar sanitation and this group has made much progress in securing the cooperation of the various railroads in working toward elimination of infestation in box cars which is one of the major sources of infestation picked up during transportation by the grain and cereal products. Because of the nature of the boxcar problem and the materials and finances involved, this will not be conquered over night, but considerable progress is being made and some of the experimental cars now in service look very good.

Another direction of effort is toward improving the condition of the raw material. This phase of the operation has long been under study and much time has been devoted to the problem. These efforts were more or less culminated in the year long wheat and wheat flour investigational program made by the Food & Drug Administration and which was reported on a short time ago.

Results of FDA Mill Survey

This program consisted of a study of insect and rodent contamination of wheat and its products. The mills used in the study were carefully selected by the Food & Drug Administration so that all categories, as to size of plant, type of wheat milled, type of cleaning and milling equip-

ment, processing methods, etc., were represented. Another group of about 100 mills was selected at random by proven sampling methods. Carloads of milling grain arriving at these plants were sampled during the 12-month period. All these samples were carefully analyzed and the results have been published and widely distributed.

Some of the conclusions drawn by the Food & Drug Administration which are important are:

1. That in general the flour mills did not contribute to the contamination found in finished flour.

2. That a large percentage of the wheat arriving at the mills for processing was contaminated with insects and with rodent excreta.

3. That present day machinery did not remove all this contamination during the milling process.

From the above it was obvious that in order to have clean cereal foods it would be necessary to keep extraneous material out, rather than try to remove it from the grain after it was contaminated.

One of the major outcomes of this investigation was the beginning of a program by the Food & Drug Administration directed toward the elevators and grain handling trades, exclusive of the farmers. While they recognize the importance of the farmer in the grain picture their jurisdiction does not cover him since he does not normally indulge in interstate commerce. This program has the same goal in mind that it had when the program was started in the milling industry and the aims are to point out and improve or eliminate the conditions that cause the grain to become contaminated by insects and rodents. The grain industry is faced today with much the same problems that faced the milling industry several years ago.

Two Phases in Elevator Program

As you all know, the program as set up for the grain trade by the Food & Drug Administration consisted of two phases:

Phase One is elevator inspection and education phase. This was begun in May and the inspectors point out the conditions that might cause the grain to be contaminated and also suggest methods of eliminating these

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conditions. It is not expected that court actions will be taken immediately except under extremely insanitary conditions which do not show any efforts toward improvement.

Phase Two of the program involves the examination of wheat on the market for rodent and insect contamination and the action to be taken where it is found. However, this phase has been postponed until July, 1953 because representatives of the grain industry convinced the Food & Drug Administration that they could, by their own efforts, make more progress through an educational program with the farmers and a research program on methods during this crop year than the Food & Drug Administration could with their regulatory program.

For those of you that are interested, the program is also temporarily being held up on the stored corn.

It is not necessary to go into the ramifications of the new program as this has been published in all the trade journals but it is of value to discuss the responsibilities of the farmer, the country elevator operator and the terminal elevator operator under this program. Each member of the grain handling team has certain powers and responsibilities to exercise to prevent contamination of the grain.

The farmer is the originator of the movement of grain to the final disposition as finished flour and other products. It is at this level that the effort must begin if the grain is to reach the final processor in a clean condition, and the farmer has an advantage if he will accept the responsibility.

For the most part, the wheat as it is harvested in the field is free from insect infestation as far as the stored grain pests are concerned. Thus the contamination must necessarily begin following the movement of the grain from the field.

A huge amount of grain is stored on the farm. If proper precautions are taken by the farmer before and after storage, he can present clean, non-contaminated grain to the next buyer.

To do this the farmer must provide a clean storage place for the new grain. This may be accomplished by thoroughly cleaning his storage places, and the surrounding area. This will include the removal of all deposits of old grain and grain products, and sweeping the bins clean. Then the insects that may remain in the bins and storage areas can be eliminated by an effective spray program in advance of the harvest. There are many formulations of good insecticides available for this purpose. Among these are Methoxychlor, DDT, Lindane and Pyrenone formulations. Combinations of some of these such as DDT and Lindane and DDT and Pyrenone are also highly effective. Any of these materials if used properly will give good insect control and help eliminate this potential source of contamination.

Protecting Grain From Rodents

Another preventive measure to be taken is the protection of the grain from rodents. The bins and storage buildings should be rodent proofed so as to prevent the entry of rats and mice. This step consists of repairing holes and other means of entry of the rodents. If wire is used it should not be of more than ¼ inch mesh. Rodent burrows in the vicinity of the storage places should be eliminated and the rodents present killed by some means such as trapping, shooting, gassing or poisoning. There are many types of safe rodenticides available to the farmer now and excellent results can be expected from their use. Foremost of these is the new Warfarin compound.

The grain should also be protected from contamination by birds as this is also considered very undesirable and is another form of contamination not generally considered along with rodents and insects.

If the farmer intends to hold his grain in storage for a period of time, he should watch it carefully for signs of heating, moisture condensation and caking. Insect activity will generally be going along hand in hand with one or several of the above conditions. High moisture grain should be dried before it is allowed to remain in long periods of storage to safeguard it from deterioration.

There are two methods of combatting insect infestation in grain that is to be put in storage. One is to treat the grain as it goes into storage with the protectant type material that has recently been developed. This material has a repellent as well as killing action on the insects and offers protection from insect infestation for long periods of time. It is not too effective, however, if placed in grain that already has a heavy insect infestation.

The other method of insect control is fumigation. Many good fumigants are available and are adapted for application to farm stored grain and in general all the standard liquid fumigants are satisfactory. These fumigants will generally control insect infestations when properly applied at the recommended dosages. Clean grain in clean storage places may become infested by the flying forms of the grain infesting insects, many of which will fly or be carried by the wind, considerable distances. Therefore the farmer must keep a sharp eye out for signs of infestation

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and take proper steps to remedy the condition when it occurs.

Clean Farm Storage Is Possible

By following the outlined methods the farmer may fulfill his obligation to the grain trade under the new grain sanitation program. Through these efforts, he not only insures better monetary return for his products, but he makes it easier for the other fellow who must necessarily handle and process the grain. This is part of the cooperative effort that is necessary to make the program work. It is also where a lot of the educational effort is needed since most of the farmers in general, as of now, are not too interested in doing much about the program. Much progress however, has been made in some areas such as Kansas, where this educational program has been directed at farmers for the past two years.

Much progress, however, has been made in some areas, such as Kansas and the Pacific Northwest, where this educational program has been directed to the farmers.

The next person who handles the grain after the farmer and who has a responsibility under the new program is the country elevator operator. This person receives the grain from the farmer and starts it on its way to the terminal markets. The country elevator operator has a three fold responsibility in his operation. The first is to see to it that the grain he takes in is in good condition and free from insect and rodent contamination. If he takes in grain that is obviously in bad condition, he is only making himself liable for action for handling contaminated grain.

Thus he must use discretion in taking the grain so as to protect his other grain storage from contamination and insure that the grain he ships will be in a satisfactory condition. In a sense this makes the country elevator operator a policeman for the Food & Drug Administration since his is the first station over which they have jurisdiction and he deals directly with the farmer anu must reject or discount his contaminated grain. The second responsibility is to maintain a clean house for the storage and processing of his grain. He must have his premises rodent-proofed to prevent their entry and subsequent contamination that will follow. He should clean the outside area so as to eliminate rodent harborages.

Elevator Clean-up Suggestions

This will include cutting of weeds, removal of trash and other items that will offer hiding places as well as the elimination of sources of food and water. Rodent burrows should also be gassed or treated with a suitable poison. As a companion effort, he should maintain bait stations both outside and inside his buildings to control any rodents that may find their way into them. He can either hire commercial operators to handle the poisoning for him or do it himself.

If he does his own he will want to use the so called nontoxic poisons and here again Warfarin is apparently giving the best results. He is also eligible to use the new liquid Warfarin which is now being sold under a limited license. This product is reported to be giving excellent results.

The interior of the elevator should be cleaned and sprayed well in advance of the grain receiving operation to eliminate this source of insect infestation. Any of the aforementioned sprays may be used and a high degree of control may be expected.

Stored Grain Should Be Checked

The third responsibility of the country elevator operator is to hold his grain in storage free from infestation. Fumigation will control any infestation that may begin or that may be established in his bins. The grain should be turned regularly and closely watched for signs of insects and it should be fumigated at the first sign of infestation. This is necessary to prevent the development of the internal insect stages. Fumigation is a good insurance policy against insect damage and should never be put off until the infestation has built up and spread. Above all, the operator should treat infested grain before it is placed in contact with clean grain. In addition to the liquid fumigants mentioned above, many of the country houses are suitable for the use of the cyanogas fumigant—which is a dry powder and which gives excellent results where it can be used.

When the elevator operator gets ready to ship his grain to other points he is responsible for taking all steps in his power to insure that the grain is shipped in a sanitary manner. The cars may be thoroughly cleaned and sprayed before loading to help minimize the chance for in-

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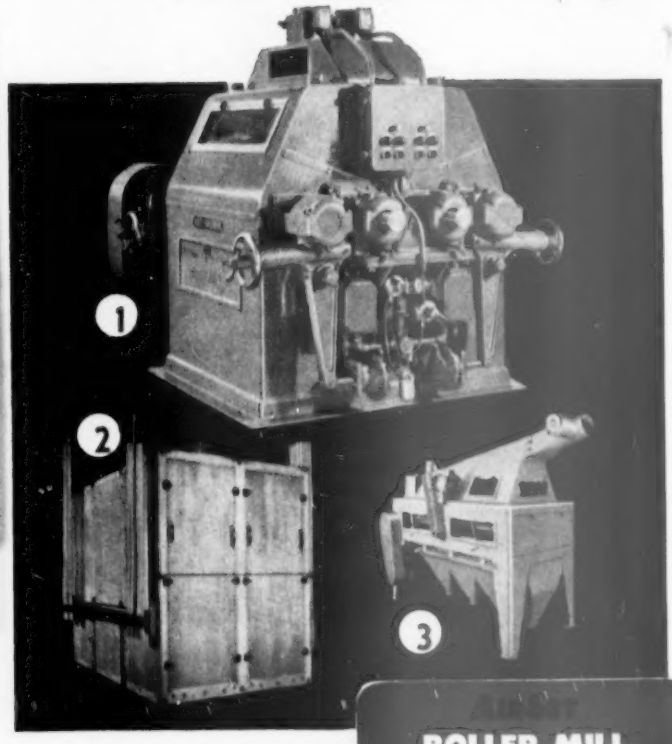

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festation in transit. They should also be fumigated at the loading point if infestation is discovered during the loading operation.

Program for Terminal Elevators

The terminal elevator operator has more at stake and must bear the big share of the responsibility for keeping the grain free from insect and rodent contamination. He receives grain in much larger quantities and from a wider variety of locations than does the country elevator operator. He has even less control over his incoming grain because he is not in as direct contact with his suppliers.

The terminal elevator operator is responsible for the grain in much the same way as the farmer and country elevator—only on a much larger scale. He must first maintain sanitary conditions in and around his plant. Rodent proofing, destruction of rodent harborages, and the establishment of bait stations are a must if he is to keep his plant free from rodent contamination. The placing of grain doors at least 18 in. off the ground, the destruction of weeds and trash piles around the property as well as the elimination of food and water supplies will go a long way in eliminating the outside rodent problem.

Need for Continuous Control

The insect problem is multiplied in the large terminals and a continuous program of insect control must be maintained. This includes constant watch on the grain as well as regular turning and a program of good housekeeping—one that will keep the elevator free from accumulations of dirt, spilled grain, old machinery and other items that habitually accumulate in an elevator. Also there should be set up a good program for spraying and grain fumigation as these are necessary to prevent the spread of contamination. Grain fumigation in particular can be a major undertaking because of the bulk of grain that is often held for rather long periods of time.

Here again the standard spray insecticides and grain fumigants, if used properly will give satisfactory results.

The screening of the elevator against bird entry is a necessary step because bird contamination, as mentioned before, is looked upon as being just as serious as rodent or insect contamination. Also the elevators seem to be a favorite hangout for pigeons and sparrows. As an additional aid there are some compounds available which repel birds and which are reported to give good results.

The terminal elevator operator is also responsible for grain shipped under insanitary conditions. He must take precautions to see that his grain is shipped under the best conditions that are possible. Considerable work has been done and is still being carried on in attempting to improve this situation, but shipping still is an imposing problem.

It certainly isn't necessary to point out to flour millers the responsibilities the industry has in the grain handling picture. Those of you that have elevator storage facilities must take every precaution that has been mentioned for the other elevator operators to keep the wheat in a sanitary condition.

The Miller's Main Contribution

Your main contribution to hastening the success of the program would be to purchase only sound sanitary wheat. That, of course, is much easier said than done if you wish to continue to operate. However, if you all would or could adopt the program of testing all your milling wheat by any of the various tests to determine its fitness for milling and reject all wheat that wasn't in a sound and sanitary condition instead of accepting what you can get regardless, as many of you are now doing, you would hasten this grain sanitation program to success much faster than all the governmental regulations ever will. Of course, it is questionable how many mills would still be in operation by that time.

To sum up the responsibilities of the farmer, the country and the terminal elevator operators and the flour mills under the new grain sanitation program, one could say that they are very much the same with perhaps the farmer holding the key position, since he first handles and cares for the grain and yet is not directly subject to action by the Food & Drug Administration. Until he is convinced of his own financial loss he may not be as careful about controlling the original insect infestation as he must do to make the whole program successful. All parties are responsible for maintaining a clean, sanitary place of storage and to protect their grain from contamination.

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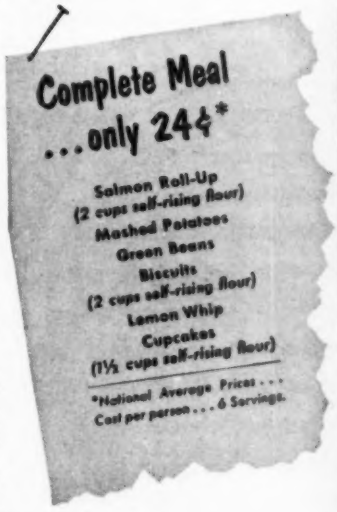

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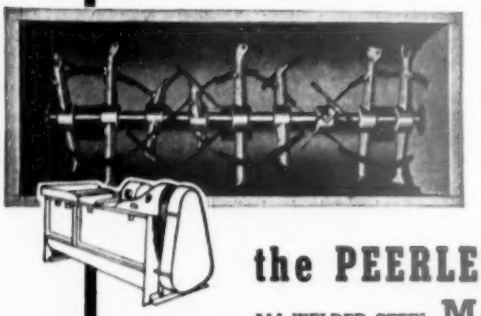

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program is to show interest and progress in moving toward the standards that have been set up. The program, as it did in the flour mills, will take time, but steady improvement will result from a willingness to do a fair share of the hard work and to cooperate with everyone concerned. If these ideas are established in the grain industry and its operations, the problems can be solved and everyone will be just that much better off and the public will be offered the type of product it is entitled to.

Breeding New Wheats for Milling Quality

By William E. Hall

THE research problem upon which this report is based was started with the hopes of answering the following questions: "Is there an association between certain agronomic characteristics and milling quality?" "What is the percentage of good and poor milling selections in early generations?" These questions were raised when the plant breeders had had a large number of new wheat varieties rejected for release because of poor milling quality. Rex, because of its excellent field characteristics, was often used as a parent variety. At one time, I suspect, the plant breeder began to feel that the millers were prejudiced to any variety that had Rex as a parent.

I would like to give briefly a few examples of genetic segregation in order to explain the principles of genetics involved in the work here. I will start with an example of barley, because barley has a simple genetic constitution. By crossing a hooded or

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EDITOR'S NOTE: The accompanying article was adapted for publication in this journal from the text of an address presented by Mr. Hall at the recent convention of the Pacific District, Association of Operative Millers. The author is a research assistant in agronomy at the Sherman Branch of the Oregon Agricultural Experiment Station, Moro, Ore.

bald barley with a bearded variety, the offspring would segregate three hooded lines for each bearded line. While there are less bearded lines than hooded ones, a plant breeder can be assured of getting quite a number of bearded lines. The same is true of two-row and six-row barley varieties. There will only be three times as many six-rowed offspring as there will be two-rowed. I say "only three times" because this is really a narrow ratio.

If we cross a hard red wheat with a soft white variety, we may get only one white to 64 red lines. This makes the chances of getting a satisfactory white variety much greater than if the odds were only 3 to 1. Thus, in crossing good and poor milling wheat varieties, I wanted to know what the chances of getting a good milling variety might be.

Shortens "Waiting Period"

From the time a cross is made, under ordinary procedure, it requires a minimum of 10 years to select the best line for release as a new variety. Starting with as many as 250 or 500 lines from each cross, the number must be reduced rapidly to the best 20 or 30 lines for disease and winter-killing resistance. Then the best yielding lines are selected and the best yielding selection was then increased for release before we faced this quality problem.

It is impossible to look at a variety and tell if it is going to mill properly, so we have been saving the 10 best yielding lines, hoping that one of them will be acceptable for milling. I am sure you can appreciate our disappointment when none of the hybrids would be satisfactory. As surely as we had selected for good agronomic characters, we had selected for poor milling, hence, the first question: "Is there an association between certain agronomic characteristics and milling quality?"

We know that there are genetic associations between plant characters. In barley, all the different characteristics are carried on just seven chromosomes, so there is a linkage between two characteristics carried by the same chromosome. An extreme example is the characteristics mentioned before of hooded vs. bearded and six-row vs. two-row barley. These two characteristics, head type and row number, are so closely associated on the same chromosome that it is nearly impossible to get a two-row hooded line by crossing a six-row hooded with a two-row bearded variety. The offspring, instead of segregating, nearly all appear as one parent or the other. In wheat, there are 21 chromosomes and most of the characteristics of wheat are carried by three different chromosomes. This should prevent such a close association between two characteristics in wheat.

It was not until two years ago when the Western Wheat Quality Laboratory developed an attachment for the Buhler experimental mill that would allow the milling of just 100 grams of wheat, permitting tests of the milling ability of a large number of hybrid lines. We were limited by the small amount of seed that can be produced in the second generation until this modification was designed. Then it became possible to mill a large number of hybrid lines before any selection had taken place and we could determine which lines were good milling ones.

600 Crosses Studied

Dr. Vogel, U.S.D.A plant breeder at Pullman, Wash., had about 600 lines of hybrids from three crosses that should have both good and poor milling lines in them. These crosses were: Uma X Brevor and two crosses of Orfed-Elgin X Brevor. Uma and Orfed-Elgin are good milling varieties and Brevor ranks as a poor milling variety.

Since this was the first time an experiment of this kind was conducted on the laboratory mill, many techniques had to be developed that would assure uniformity throughout the different millings. The procedure used was generally the same as that used by E. F. Seeborg, the miller at the laboratory. It was possible to mill 16 samples a day. To test the uniformity, the parent varieties were milled, under a laboratory number, on alternate days. The parent varieties were milled a total of twelve

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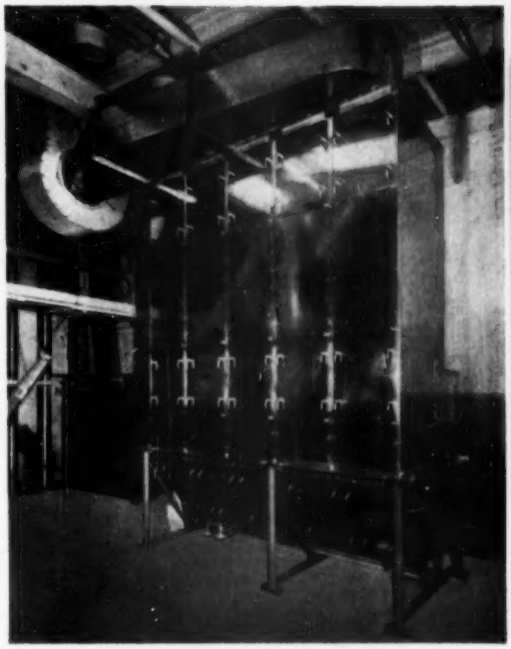

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times. Statistical analyses of flour yield, bran weight and total shorts showed the varieties to be different, but there were no differences between milling dates. This indicates that differences found in the hybrid lines were not due to changes in the mill.

The first hybrids milled were from the Uma X Brevor cross. Here I found my first serious technique error. I had sampled a number of lines from each cross to determine the moisture content for tempering, but had assumed that all lines would be soft, as the parents were, and had tempered to 14% moisture content. These lines of Uma X Brevor proved to be harder than expected. The middlings were too hard to reduce properly but all appeared to be excellent milling. The bran clean-up was exceptionally good on all lines. A total of 107 lines from this cross were milled.

After this milling, texture determinations were made and it was found that the Uma X Brevor hybrids had a particle size index of 14.76 and the two Orfed-Elgin X Brevor crosses had particle size indexes of 20.98 and 23.34. The two latter could then be tempered properly at 14% moisture.

The two Orfed-Elgin X Brevor crosses gave a good range of different milling hybrids. These crosses differed by being different plants from the parent varieties. In a study of smut resistance one cross had given one resistant line to 16 susceptible lines, the other had given one resistant line to 64 susceptible lines; so, it was expected they would represent two different populations. This proved to be true in the milling of the hybrids. The population mean and standard deviation for flour yield, total shorts, bran weight and break release differed between the two crosses. In both crosses hybrids exceeding both parents were found.

A total of 213 lines from both crosses were milled, 109 from one cross and 104 from the other. For flour yield, 32 lines exceeded the average of the better parent, Orfed-Elgin, and 36 were lower than the average of Brevor, the poorer parent. There were 76 lines which had less total shorts than Orfed-Elgin and 33 had more than Brevor. Only six lines had less bran weight than Orfed-Elgin and 17 had more than Brevor.

In addition to these characteristics that could be measured by weight, each line was classified as to its bran clean-up and flow behavior. Bran clean-up was a comparison of the amount of whiteness on the bran of the hybrid to that of Brevor, Orfed-Elgin or Uma. Brevor was rated as poor, Orfed-Elgin as good, and Uma as excellent. Between Brevor and Orfed-Elgin was a classification of fair. None of the hybrids of the Orfed-Elgin crosses rated excellent in bran clean-up, but 15 rated good and 62 rated poor.

Flow behavior was a very subjective test, but was based mainly on the rate of flow through the second and third reduction feeder rolls. If this stock were hard and sharp, the flow was rapid and rated as excellent. If it were soft, the flow was slow and it was rated as poor. Brevor was very poor and could easily be identified by this characteristic. Uma was the fastest flowing and rated excellent and Orfed-Elgin rated either good or excellent. There were 13 lines classified as poor flowing and 29 as excellent flowing.

The ideal variety would be the hybrid which was outstanding in all characteristics. I did not find any in the 213 lines I milled. The highest flour yielding line had only fair bran clean-up. A line might have excellent flow behavior, and have a low flour yield or poor bran clean-up.

This leads to the study of association between characteristics. The degree of association varied between the two crosses. In one cross the association between break release and flour yield was very high, in the other cross it was quite low. Bran weight and flow behavior were associated rather highly in both crosses, the higher the bran weight the poorer the flow. Bran weight and bran clean-up were highly associated in one cross but not in the other. I believe this difference in associations might be expected in hybrids from different crosses.

How to classify a line as good milling, when milling consists of several independent characteristics is a big problem. Particularly so, as I mentioned before, is when a variety good in one characteristic is poor in another. I devised a scoring formula to give me a milling score for each line. It is no doubt crude and may not rank the hybrids correctly from an economic standpoint, but it gives me a basis on which to rank the lines. It consists of adding 10, 15, 20 or 25 points for poor, fair, good or excellent ratings of bran clean-up and flow behavior to the flour yield and dividing this sum by the total of bran weights and shorts. Thus the higher the flour yield and better the bran clean-up and flow behavior the larger the sum to be divided by the bran and shorts. It gives the greatest emphasis to flour yield but also reflects the other characteristics.

Using this scoring system, there were 13 hybrids which scored higher than Orfed-Elgin and 12 scored less than Brevor. A variety yielding 67.5%

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flour with bran clean-up and flow behavior both classed as good, would score 3.31. I believe this would be the minimum acceptable score. Orfed-Elgin scored 3.62 and Brevor 2.40. There were 37 lines of the 213 which scored higher than 3.31. Thus in answer to the question "What is the percentage of good milling lines in a hybrid?" I found about 17% acceptable.

From these mathematical odds it should not be too difficult to obtain a good milling line from the cross of a good and poor milling parent. I think I might have found the reason that we have failed to get one, and it lies in the other main question about an association between agronomic characteristics and milling quality.

Dr. Vogel determined the smut resistance of each of these lines the same year they were grown for milling. He classified each line as being smut-free or having a certain percentage of smut. Of the 37 lines I scored as acceptable for milling, only three had 5% or less smut. This may indicate an association between smut resistance and milling behavior. If this association does exist, it would give the reason that so many of our recent hybrids have not milled properly. This is because we have thrown the good milling lines away when we found they were susceptible to smut. For example, if those crosses had been treated as our other crosses are, and not milled at this early stage, all of the smut susceptible lines would have been discarded. This means of the 213 lines, 49 were smut resistant and would have been kept. Unknown to us only three of these 49 are good milling.

During the next year or so these 49 lines would have been subjected to tests for desirable characteristics which could be seen; such as, winter hardiness, plant vigor and stiffness of straw, until only five or 10 would remain. Then we would test them for high yield and satisfactory milling behavior. It would be very easy to have eliminated our three good milling lines before the milling trials took place, as milling behavior is unobservable in the field. No doubt this has occurred in our crosses with Rex and Elgin.

There is much more work to be done. I was able to mill only half the lines of each cross. My findings would be much more important if they were substantiated by further work with those un-milled lines. It would be interesting to see if the Uma X Brevor cross gave similar results when milled after tempering at a higher moisture content. By far the best bran clean-up of any hybrids were found in this Uma X Brevor cross, which may have been due to the improper tempering and at higher moisture content perhaps the bran clean-up would not have been as good.

During the milling of these lines much more detailed data were collected than I have described here. Weights of the first and second break release were made, the second and third middlings were weighted and the shorts were broken down into bran and flour shorts. A more critical study of this data might show additional information. I think the association of flour shorts and flow behavior would be very interesting. I am not familiar enough with the principles of milling to go into that further and am turning the data over to Dr. Barmore and Mr. Seeborg.

I want to thank this Association of Operative Millers for its assistance in making this study. I feel very fortunate in having had the opportunity to conduct this research inasmuch as it is the first of its kind. I am sure the wheat breeders will be very interested in the relationship of smut resistance and milling quality that is demonstrated. I hope the millers will have something equally valuable, and if it has shortened the time until a better milling variety than Brevor can be developed I am sure you will have benefited.

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Before going into the matter of babbitt metal, it may be advisable to consider what properties a bearing should have in order to function properly. Obviously, it should be softer than the shaft it supports, because it is cheaper to replace the bearing than the shaft itself. It must be non-abrasive and non-scoring; and it should be of such a nature as to retain the oil as far as possible when the machinery is not running, so

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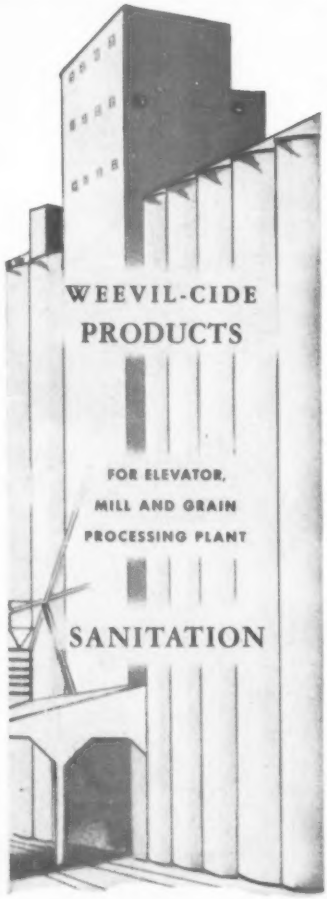
there will be little risk of starting up "dry." To obtain these results, it has been found that alloys are preferable to single metals—whether the bearing is of brass or bronze, or of babbitt. Moreover, these metals should be so proportioned that although they will mix intimately when hot, they tend to separate out somewhat on cooling. The effect of this is to form crystals of the harder constituents, and these are embedded in the softer material. Thus the crystals are hard enough to support the load without crushing, and the softer metal or metals form a cushion which permits the crystals to conform accurately to the shaft contour. Moreover, since the microscopic irregularities which exist in all shafts tend to wear the directly exposed parts of the softer metal faster than the rest of the bearing, a succession of tiny "pockets" is created by this natural wear. These pockets tend to retain the oil film in close contact with the shaft while the latter is not revolving. While running, of course, the shaft and bearing material do not touch anyway, and are always separated by a film of oil which takes the friction load.

Babbitted bearings have a number of advantages over "hard" bearing alloys. They can be readily cast, and little if any finishing is needed. On the other hand, a hard bearing must be machined, and when worn out must be entirely replaced and refitted.

Owing to the extreme variations now encountered in both load and speed in modern machinery, a wide variety of babbitts has been compounded for these differing needs. Thus, it often pays to consider the particular use to which your babbitt is to be put before buying it—or getting it from the stockroom, as the case may be. The prices of babbitt alloys differ very much, according to their constituents and the proportions of each. So do their properties under load. The two main types are known as "tin-base" and "lead-base," respectively. Tin-base alloys are those in which tin is the principal constituent. Lead-base alloys are principally lead. Each has its special advantages.

"Tin-base" babbitts are used wherever the load is severe especially if reciprocating, as in connecting rod bearings in an automobile, or if both speed and load are high, as in woodworking machinery, rolling mills, etc. "Lead-base" babbitts are preferable where load and speed are low, such as with lineshafts, slow-moving machinery and in general mill work. Unless, therefore, the right kind of babbitt is selected, there may be trouble or waste. To use a lead-base alloy on a heavily-loaded main engine shaft is inviting trouble, because it probably will not stand up to the conditions for long. On the other hand, to employ a high-tin-base material to a lineshaft bearing would not give any better



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results than if the ordinary lead-base were used—but it would probably cost five or six times as much. Tin is costly. Where only occasional rebabbitting is done, it may pay to use the more costly alloy in order to avoid the need of keeping two or three kinds in stock—but it should be done with a clear understanding of the higher expense of material.

There have been a great number of babbitt alloys put on the market under special names. Since they are all made of varying proportions of tin, lead, antimony and/or copper, it seems that it would be more logical to buy them under a definite specification. Of course, these specially-named brands give, as a rule, excellent results in proper applications. They could not be sold for long unless they did. And it is an excellent idea to stick to a good thing when you have proved its qualities. But just the same it might be well to find out for yourself whether you are using something too costly for some of your jobs, and whether something at one-fifth the price and with a higher lead content might not do just as well. Naturally, you wouldn't try it out on the main engine bearings as a first test. Try some less important spot—bearing in mind the load and speed conditions to be met.

Much uncertainty in buying babbitt has now been eliminated by the American Society for Testing Metals. Each alloy has been carefully tested, and very complete practical data given on such important points as its melting and pouring temperatures and physical properties.

It is scarcely necessary to give the method of setting up the shaft and bearing preparatory to pouring the babbitt. However, all traces of dirt, oil and dampness should be removed, for the sudden creation of steam or oil vapor when pouring may easily lead to a serious accident, besides the possibility of a blowhole in the babbitt which would cause failure of the bearing long before its time. If an exceptionally smooth casting is required—which is practically always—it isn't a bad idea to smear the shaft with chalk or talcum powder, or to smoke it up with a candle-flame or by a burning rag soaked in turpentine; but this latter should not be done if the shaft is cold and the air moist, as moisture condensation may take place which would cause the danger mentioned above. However, both shaft and bearing should be pre-heated before pouring, anyway. Never use a ladle or pot which is not thoroughly clean; any traces of zinc or aluminum are particularly objectionable.

Melt up plenty of metal for the job. The more there is, the less it will tend to cool during pouring, and the less it is liable to get overheated. Moreover, it won't do to run short of filling the entire space available. Stir and skim the metal well before pouring. Under-heating will result in an imperfect casting. Prolonged overheating may spoil the qualities of the alloy by destroying the more easily oxidized constituents, leading to the formation of excessive dross. With lead-base babbitts it is still possible to rely to some extent on the old "rough-and-ready" test of seeing if paper will char in the melted metal; but with tin-base alloys about the only way is to rely on a pyrometer or some other reasonably accurate means of judging the temperature.

It may be mentioned that for those who do not care to go hunting around the plant for clay to use for plugging up the ends of the bearing before pouring, several special materials which will keep indefinitely in cans may be obtained from mill supply stores.

With regard to the oil grooves which are cut in the bearing after casting, it is generally agreed that a bearing less than one inch long does not need grooves, because the oil will spread that much on either side of the oil-source—oil-ring, chain-feed, or sight-feed needle, etc. The edges of all oil-grooves should be slightly chamfered, otherwise the sharp edges will tend to scrape the oil off the shaft instead of distributing it where it ought to go. It is also a mistake to overdo the matter of oil grooving, either in number or depth of grooves; especially so if the ends of the grooves come too near the ends of the bearing. Oil-throwing, seepage and oil-waste are the natural outcome of this.

Regarding scraping, it is not advisable to do more of this than will assure a good fit between shaft and bearing. Excessive scraping is, in fact, likely to break down the crystalline structure of the running surface, with the result that the bearing may fail to hold its oil during stopping periods. A clearance of .001 in. between shaft and bearing is about right, and allows ample space for the thin film of oil which must separate the two while running.

The importance of proper lubrication to prevent overheating of babbitt bearings may be readily seen from the rapid decrease in elastic limit and Brinnell hardness from normal air temperatures to that of boiling water.

—BREAD IS THE STAFF OF LIFE—

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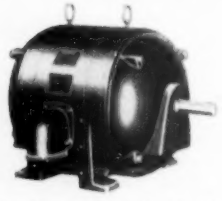

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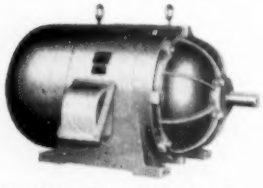

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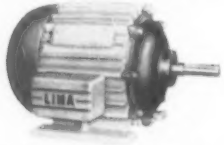

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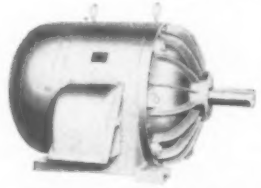

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Canada Plans Study of Dust Explosions

WINNIPEG — The National Research Council, operating through a strong team of senior experts, has gone into action at the Head of the Lakes to conduct scientific research into the cause of dust explosions in an attempt to remove the hazards from grain handling.

This information was reported by the directors to delegates of the Saskatchewan Wheat Pool during the course of their annual meeting at Regina, Sask., recently.

Twice within the last seven or eight years dust explosions have occurred at Port Arthur with serious loss of life and property.

The second explosion occurred in Saskatchewan Pool Terminal No. 4 after very heavy expenditures had been made in the installation of the most modern dust elimination equipment known to the trade.

Following the second explosion which occurred on Sept. 24 this year, the Minister of Trade and Commerce requested the National Research Council to review the whole situation with a view to recommending preventive measures.

The management of Saskatchewan Pool Terminals, Ltd., has instructed all operating personnel to cooperate with the Research Council to the fullest extent in the work of the investigators.

Delegates were advised that immediately following the explosion, work was started on demolition of rubble in the effort to get the terminal back into operation at the earliest date possible.

According to a report submitted by the directors, it is expected that the storage annexes affected by the explosion, providing for storage of 6.5 million bushels of grain, will be back in service in about six months' time. The workhouse, where the damage was most extreme, will probably be in service in about 12 months' time.

——BREAD IS THE STAFF OF LIFE——

St. Lawrence Ports to Exceed '51 Total for Grain Shipments

WINNIPEG — Speaking in Winnipeg last week, Roy Milner, Federal Transport Controller, stated that an overseas movement of 50 million bushels of prairie grain was planned for St. Lawrence ports in the period from Nov. 1 to the close of navigation on the river.

"This would bring total shipments from the start of the crop year to the close of river shipping to some 120 million bushels, as compared with slightly more than 93 million bushels for the same period last year."

Mr. Milner was in Winnipeg for talks with grain and transport officials in connection with the big fall movement.

He said that the build-up of iron ore stock piles at eastern steel mills would be completed at the end of last week, and as many as possible of the ore vessels would then join the grain fleet.

The transport controller said that plans for the Great Lakes grain movement called for 200 million bushels to be shipped eastward from the lakehead in the period from Aug. 1 to the close of navigation, about Dec. 15.

Shipments up to Nov. 19 amounted to 155 million bushels. That left 45 million to be taken down the lakes during the remaining weeks until freeze-up, and Mr. Milner believed the 200 million-bushel goal could be reached.

He indicated that it was by no means certain, what proportion of the iron ore fleet on the lakes would move into the grain trade when the iron ore build-up was completed.

It might develop that the grain trade could not use all the lake vessels that could be switched into the haul, in which case, the ore build-up might continue right up to the close of navigation.

The benefits for the grain haul would be postponed until spring. Then with the opening of navigation on the lakes the iron ore fleet might be directed into grain for the first few voyages of the new season.

This would ensure, Mr. Milner suggested, a tremendous movement in the period immediately following the opening and a rapid reduction of stocks built up at lakehead terminals during the winter months.

Commenting on supplies at St. Lawrence ports, the transport controller said that they had always been far in excess of the requirements of incoming vessels. Figures showed, he said, that St. Lawrence stocks were actually on the increase, despite the heavy loadings.

1953 WILL BE TOP YEAR

FARGO—Economic conditions indicate that 1953 will be a favorable year for agriculture, according to Harry G. Anderson, North Dakota Agricultural College Extension Service farm economist.

——BREAD IS THE STAFF OF LIFE——

FERTILIZERS PAY OFF

Use of commercial fertilizers on small test plots by Griggs County, N.D., farmers increased yields when applied in drill rows, according to George Simons, county extension agent.

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Flour Yields

(Continued from page 1a)

does not carry the amount of dockage that is found in spring wheat or down in the hard winter wheat country.

That superintendent said, "The reason we seem to be doing a better job of milling than the average is due to that fact rather than to the fact that we might be better millers."

With regard to the wheat-over-rolls yield, this Pacific Northwest superintendent said that it usually requires more wheat than is represented by the total quantity of flour and feed produced, explaining the discrepancy was due to the fact that the moisture of the tempered wheat is higher than the moisture of the finished products are to evaporation during the milling process.

Yields Have Various Values

"Yields, to me, have various values," a superintendent of a spring wheat mill asserted. "There is a place for the dirty wheat yield or wheat as received by the elevator; the clean tempered wheat yield immediately above the first break roll; and the production yield.

"Dirty wheat or elevator yield should be used to figure costs of production as this is the wheat that is purchased," he said. "Most mills use this yield in the figuring of their flour costs because it is the only yield that gives a true value in this respect," he continued. The spring wheat mill superintendent went on to say that the clean tempered yield taken from wheat immediately above the first break roll has value only to the milling superintendent as it may not correlate with the dirty wheat yield because of screenings removed and moisture added. He pointed out, however, that it is an indicator of the efficiency of the mill proper to the man who is operating that mill.

With regard to the production yield, he said that it has value as a further check against the other yield figures such as automatic scales being out of balance and not weighing properly, etc. It is also the only method a miller can use to figure yields that does not involve the process of weighing the wheat itself as it goes to the mill.

'Uniform Report Not Possible'

"It seems to me that it would be a bit difficult to report yields from over the country in such a manner that they would make sense unless it was also possible to include some of the other factors which influence those yields," he said in his comment about whether or not a uniform

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method could be worked out for reporting flour yields.

A mill superintendent in the Southwest said that, to his way of thinking, there are four different general classifications of yields and those are product yield, dry clean wheat yield, wet clean wheat yield and dry elevator wheat yield. He said that there must be various sub-classifications from each of these general yields, particularly with reference to product yield and elevator wheat yield to compensate for the individual mill's method of handling dockage, elevator screenings and mill screenings. The Southwest mill superintendent outlined his mill's method of computing yields as follows:

"In our own case we have three different yield figures. From the administrative end, we prefer the product yield and the dry elevator wheat yield. One end is the buying side and the other end is the selling side and what happens in between is, at best, a guide for the superintendent in his daily operation.

"Our inventory and production records are kept on the basis of product yield with the mill packed dry every day at 4 o'clock. At that time the total pounds of feed and flour is added together and is divided by 60 for the bushels of wheat used and the number of sacks of flour is divided into the bushels of wheat shown by such calculations as this gives us our product yield.

"All elevator and mill screenings are ground through the hammermill and into millfeeds. We do not have adequate facilities for weighing dry dirty wheat from the elevator to the mill and, as a consequence, this yield figure is only obtained at the end of the crop year when we have a weigh-up or measure-up of our elevator." The superintendent explained that, for purposes of mill production control, he plans to install an automatic scale over the screenings bin so that it will be possible to deduct the amount of screenings each 24 hours. This will then, in effect, supply them with a wet clean wheat yield for the miller's information.

The mill superintendent went on to say that his company's reports to the Bureau of the Census are all based on product yield because of the company's inability to supply the Census Bureau with monthly figures on any other basis. He said that he thought the differences noted between the various states and sections of the country would, in a large measure, be accounted for in their methods of calculating yields and the probable natural moisture content ground.

"If I were guessing, I would say that the Pacific Northwest very probably weighs their dry dirty wheat at the mill and they have some very low moisture wheats to start with," he said.

While he did not favor adoption of a uniform nationwide method of reporting flour yields, the Southwesterner said that he thought the nearest thing to a common ground that could be used for Census Bureau purposes would be a product yield figure but that, at best, would not be too accurate unless a common method were found for compensating for elevator and mill screenings and a common procedure for handling dockage.

The miller from the Southwest finds agreement with his statement that the fairest basis for making comparisons is the product yields basis. The agreement came from a miller in the Intermountain area and he pointed out that the product yield basis excludes the influence of moisture gain or loss on the figure obtained. It should be taken into account, however, whether or not scourer dust or ground mill run screenings are fed into the feed as this will also alter the results in figure, he pointed out. This Intermountain miller figures his yields once each 24-hour period and he said that it has been averaging 137 lbs. and that the dry wheat yield or elevator yield was figured only once each month on the basis of rough cleaned wheat delivered to mill bins in the elevator and that the rough clean wheat basis runs about 3 lb. lower. That figure would represent the difference between the amount of screenings taken off. It has been rough-cleaned before being sent on to the elevator bins for more cleaning.

Uses All Three Methods

A miller in the Central States area agrees with his colleagues that it is advisable to compute yields on all three bases, elevator, wheat-over-rolls and production yields.

"We feel that, by keeping tab on these three levels, we can readily compute loss or gain wherever it may be. It is dependent upon various conditions, one of which is moisture.

"To us a production report is not complete without these factors and cannot be used as a comparison unless the reports are all given on the same basis. Of course, we feel all yield reports would be more readily understood by all if the thing could be standardized the country over." But, like the others, he agrees that there are probably too many variable factors which would have to be included in arriving at a common reporting base and he suspects, too, that those reports would be adding to, rather than taking away, some of the misunderstanding or confusion that might arise from the present method of reporting. So, it seems that he is content to go along with reporting yields as they have been reported in the past.

It would probably be noted from an examination of the material presented in the table at the beginning of this article that mills in Minnesota and Washington apparently are doing a better job of milling than are mills in other parts of the country. This, however, is not a safe assumption after a statistical analysis is applied to the data. It was thought after examining the 1951 summary issued by the Census Bureau, that the data for Minnesota and Washington might be above or below the average of those two states. For that reason an examination of Census Bureau reports for prior years was examined and the results analyzed statistically. The product gain for Minnesota mills during 1951 amounted to 1.7 lb. as against a 25-year average of 1.53 lb.

For Washington the 1.3 lb. product gain for 1951 compares with a long-time average of 1.14 lb. gain.

The chances are 1% or less that there is a true difference in the variation of product gain and the mean of the products gain in the two states. The analysis disclosed that the Minnesota and Washington results show the same mean and same variance.

The data for those two states were the only data tested statistically. It is probable, however, that the results would be the same if the data for other states were analyzed for other years as well as for 1951.

A recent article in Milling, British milling industry journal, discloses that in addition to the elevator wheat, wheat-over-rolls, and product yield bases, the British miller also

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uses two additional bases: First, the weight of unwashed wheat after the screenings have been removed and second, mill products not including screenings. This latter method is contrasted with the total products base; that is, flour, millfeed and screenings. The clean unwashed wheat base, as with the elevator wheat method, allows for wheat processing and milling loss.

The other method—mill products not including screenings, does not take into account any gains by conditioning, milling loss or screenings extracted. It is, therefore, only of use for a comparison of the working of the mill from one period to another and is not an absolute measure of the efficiency of the mill.

The total products method; that is, the weight of the flour, millfeed and screenings, is the method stipulated by the British Ministry of Food for calculating the flour extraction rate for the country's National flour. In other words, National flour produced in Great Britain must represent 81% of the total products from the wheat as received. It is a very simple method of calculating extraction and can be assessed accurately over long and short periods, the figures being readily available from the packers' sheets and where screenings are taken off separately from the screenings weigher, the article in Milling pointed out. This method, however, does not take into account gains or loss in the screen room or milling loss, but screenings extracted are included in the calculation.

It is apparent then, that what is called 81% extraction flour in Great Britain would be regarded as about 83% extraction flour in this country for the reason that in many sections of this country it is the custom to compute flour yields on a clean wheat basis rather than elevator wheat basis.

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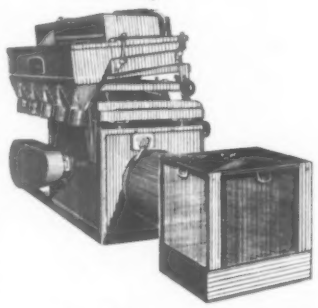

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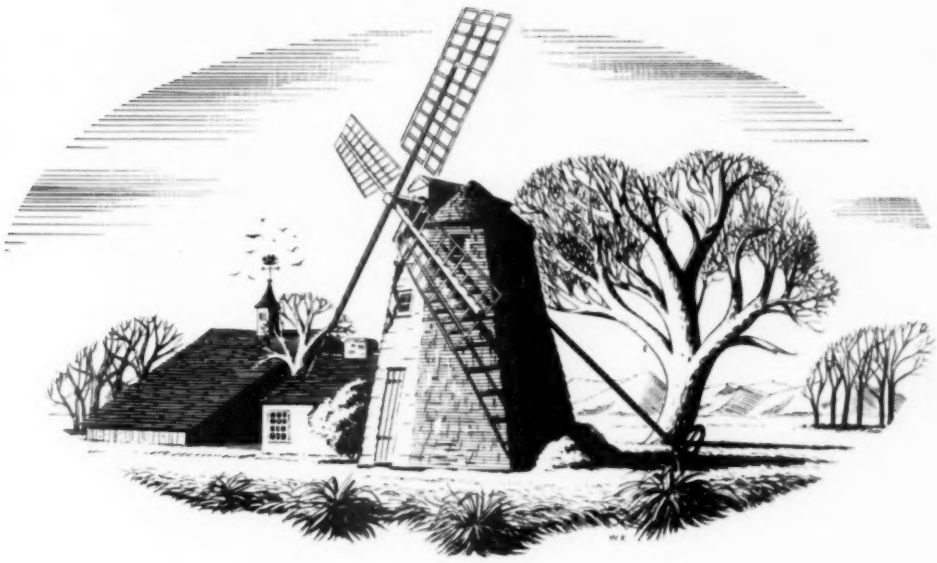
How to make good food better



To the old-fashioned miller came many grains—wheat, corn, oats, rye—to be ground into flour. Modern milling practice loses some of the nutritional benefits present in Nature's wheat because of consumers' demand for patent flour and for white bread and rolls. How sensible it is that you restore valuable health-giving vitamins and minerals through enrichment. Your achievement in making your good foods better by this simple process of enrichment has the support of qualified authorities—physicians, nutritionists, dietitians, and of consumers themselves.

keeping faith with nature

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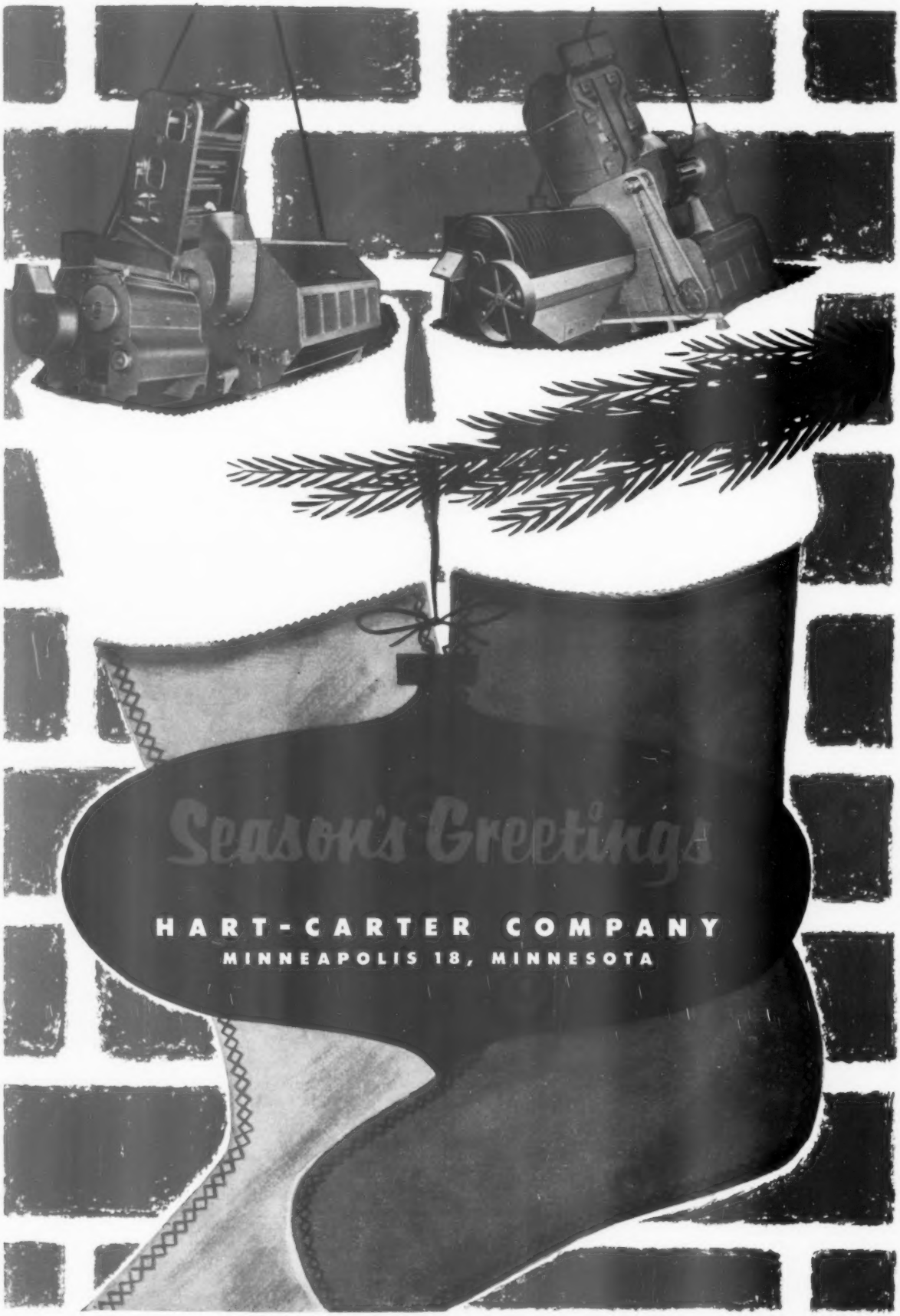
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